

A Plethora of Projectile Puzzles

For all of these puzzles, ignore effects of air resistance. Let $g = 9.80 \text{ m/s}^2$. For numbers 2.1-3.4, use the same puzzle solving strategies you employed on the last assignment.

- 1.1 The altitude of a hang glider is increasing at a rate of 6.80 m/s. At the same time, the shadow of the glider moves along the ground at a speed of 15.5 m/s when the sun is directly overhead. Find the magnitude of the glider’s velocity.

Ans:

- 1.2 A jetliner is moving at a speed of 245 m/s. The vertical component of the plane’s velocity is 40.6 m/s. Determine the magnitude of the horizontal component of the plane’s velocity.

Ans:

- 1.3 A dart is thrown upward at an angle of 25° above the horizontal. The vertical component of the dart’s velocity is $v_y = 2.2 \text{ m/s}$. Determine the x component of the velocity.

Ans:

- 2.1 A car drives straight off the edge of a cliff that is 54 m high. The police at the scene of the accident note that the point of impact is 130 m from the base of the cliff. How fast was the car traveling when it went over the cliff?
- 2.2 A horizontal rifle is fired at a bull’s-eye. The muzzle speed of the bullet is 670 m/s. The barrel is pointed directly at the center of the bull’s-eye, but the bullet strikes the target 0.025 m below the center. What is the horizontal distance between the end of the rifle and the bull’s-eye?
- 2.3 Another bullet is fired from a rifle that is held 1.6 m above the ground in a horizontal position. The initial speed of the bullet is 1100 m/s. Find the time it takes for the bullet to strike the ground and the horizontal distance traveled by the bullet.
- 3.1 A quarterback throws a pass to a receiver, who catches it at the same height as the pass is thrown. The initial velocity of the ball is 15.0 m/s, at an angle of 25.0° above the horizontal. What is the horizontal component of the ball’s velocity when the receiver catches it?
- 3.2 The punter on a football team tries to kick a football so that it stays in the air for a long “hang time.” If the ball is kicked with an initial velocity of 25.0 m/s at an angle of 60.0° above the ground, what is the “hang time?”
- 3.3* In the Olympic skiing aerials competition skiers speed down a ramp that slopes sharply upward at the end. The end of a typical launch ramp is directed 63° above the horizontal. With this launch angle, a skier attains a height of 13 m above the end of the ramp. What is the skier’s launch speed?
- 3.4 If a projectile has a launching angle of 52.0° above the horizontal and an initial speed of 18.0 m/s, what is the highest barrier the projectile can clear and what is its maximum range?